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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/330,418	06/11/99	TAYLOR	G 50261-2

EXAMINER	
ART UNIT	PAPER NUMBER
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03/13/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/330,418	Applicant(s) Taylor et al.
	Examiner Sin J. Lee	Group Art Unit 1752

☒ Responsive to communication(s) filed on *Dec 27, 2000*

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *three* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) *19-28* is/are pending in the applicat

Of the above, claim(s) _____ is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *19-28* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____ .

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *6*

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

1. Claims 1-8 and 14-18 are canceled by applicants.

2. In view of applicants' amendment filed on December 27, 2000, the previously applied prior arts, Allen et al (5,786,131) and Johnson et al (Proceedings of SPIE-Int'l Society for Optical Engineering, vol.3049, pg.997-1009), are not being used to reject present claims because Allen et al teach the previously claimed pendant acid-labile group, isobornyl group, and Johnson et al teach the previously claimed pendant acid-labile group, heteroalicyclic group. The present claims do not claim these specific acid-labile groups any longer.

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 24-25 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 24, applicants recite "the *polymer* consists essentially of the photoacid generator compound and the polymer", and in claim 25, applicants recite "the *polymer* consists essentially of the photoacid generator compound, the polymer and a base component". There is no support for these limitations in the present specification.

5. It is to be noted that the present claims 24-25 could not be rejected over Shida et al'207 nor over Goodall'WO'198 since neither of the references teach a polymer wherein a photoacid generator and a base component exist *as part of the polymer* as presently claimed. However, if applicants change the limitations of claims 24-25 from "the *polymer* consists essentially of . . ." to "the *photoresist composition* consists essentailly of . . ." the claim 24 will be rejected over Shida et al'207 as well as over Goodall'WO'198, and the claim 25 will be rejected over Shida et al'207 in view of Niki et al (5,658,706) (a reference which teaches the addvantage of adding a base component to a positive chemically amplified resist composition) as well as over Goodall'WO'198 in view of Niki et al'708.

6. Claims 19-20, 23, and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shida et al (6,060,207).

Shida et al teach a photosensitive material useful for forming a fine pattern in the manufacture of a semiconductor device and the like (col.1, lines 5-7). Shida teaches in col.8, lines 15-31 that their chemically amplified resist can be used *either* in the form of *positive type* or *negative type* resist depending on the selection of its component to be included. If the resist is to be used as *positive tone* resist, the prior art teaches that the resin component should preferably be a copolymer of vinyl compound having as a side chain a molecular structure represented by the formula (1) (see col.5) or an acrylic compound represented by the formula (5) (see col.6) *and* a monomer having a functional group to be decomposed by an acid. The prior art furthermore teaches that when the resin component is a copolymer of a monomer represented by the formula

(2) (see col.6) and a compound containing a functional group to be decomposed or cross-linked by an acid, it can be formulated into a suitable chemically amplified resist by incorporating therein a *photo-acid generator*. As one of examples for the functional group to be decomposed with an acid, the prior art teaches ally ester (col.8, lines 40-50).

In its Example II-2, Shida et al teach a copolymer of allyl methacrylate (*an ally ester which is a compound containing functional group to be decomposed by an acid as taught by Shida*) and menthyl methacrylate (*a vinyl compound having as a side chain a molecular structure represented by Shida's formula (1) and also a monomer represented by Shida's formula (2)).* Although Shida et al use the copolymer for a negative type resist in this specific example, since the prior art clearly teaches that such copolymer can be used in the form of positive type resist when combined with a photoacid generator, one of ordinary skill in the art would have immediately envisaged using the copolymer together with a photo-acid generator (instead of the polymerization initiator used in the Example II-2) to formulate a suitable chemically amplified positive resist with a reasonable expectation of providing a photosensitive material which is excellent in transparency to a light source of short wavelength and has a sufficient dry etch resistance. Therefore, Shida teaches the presently claimed positive-acting photoresist composition comprising a photoacid generator and a polymer that is free of aromatic groups and that comprises pendant acid-labile groups containing an alkenyl group.

With respect to present claim 23, since the copolymer of Example II-2 contains the menthyl methacrylate (which is a cycloalkyl ester) repeating unit, the prior art teaches the present invention of claim 23.

Since Shida teaches (col.34, lines 31-42) that their photoresist material dissolved in an organic solvent is coated on the surface of substrate such as silicon wafer, the prior art teaches the present inventions of claims 26-28..

7. Claims 19, 21, 23, and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shida et al (6,060,207) in view of Goodall et al (WO 97/33198).

In Example II-148 to II-151, II-188 to II-191, Shida et al use a chemically amplified resist comprising a photoacid generator and a resin containing *isobornyl* methacrylate, menthyl methacrylate and methacrylic acid units. Also, in Examples II-156 to II-159, Shida teaches a chemically amplified resist comprising a photoacid generator and a resin containing *tetrahydropyranyl* methacrylate, menthyl methacrylate and methacrylic acid units. In all of these Examples, Shida coats the resist solution onto a *silicon wafer* before exposing it and then developing it to form a pattern.

Shida et al do not teach the presently claimed acid-labile group comprising optionally substituted cycloalkyl group having 3 or 4 ring carbon atoms. However, Goodall et al teach (in their claim 2) the equivalence (as protecting groups that are acid-cleavable by photoacid generators) of *isobornyl group* or *tetrahydropyranyl group* to *dicyclopropylmethyl group and dimethylcyclopropylmethyl group (both of which are substituted cycloalkyl group having 3 ring*

carbon atoms as presently claimed). Since the isobornyl group or tetrahydropyranyl group (both of which are taught by Shida) are art-recognized equivalents to the dicyclopropylmethyl group and dimethylcyclopropylmethyl group, one of ordinary skill in the art would have found it obvious to substitute the isobornyl or tetrahydropyranyl group of Shida et al's resin for the dicyclopropylmethyl or dimethylcyclopropylmethyl group with a reasonable expectation that these latter two would function the same way as the isobornyl or tetrahydropyranyl group to provide a photosensitive material which is excellent in transparency to a short wavelength and has a sufficient dry etch resistance. Therefore, Shida et al in view of Goodall et al teach the presently claimed positive-acting photoresist composition comprising a photoacid generator and a polymer that is substantially free of aromatic groups and that comprises pendant acid-labile groups containing a cyclo alkyl group having 3 ring carbon atoms.

Since Shida's resin contains menthyl methacrylate (a cycloalkyl ester) repeating unit, the prior art teaches the present invention of claims 23 and 28.

8. Claims 19, 21-23, and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodall et al (WO 97/33198).

Goodall et al teach a photoresist composition comprising a polycyclic polymer, which contains recurring acid labile groups that are pendant from the polymer backbone, and a photoacid generator. See particularly, pg.1, lines 10-12, lines 17-22, lines 25-26, pg.6, lines 24-27, pg.7, lines 6-7, lines 11-14, lines 26-29, pg.8, lines 1-30, pg.9, lines 1-10, pg.10, lines 11-30,

pg.11, lines 1-6, pg.12, lines 1-14, pg.48, lines 11-13, pg.49, lines 9-16, pg.81, lines 5-7, claims 1-2, 11-12.

On pg.8, Goodall et al teach the acid labile polycyclic monomer having formula I which makes their polymer. According to the formula, the acid labile group $-(CH_2)_nC(O)OR^*$ has to be always present, and ten examples for the R* moiety (i.e., acid decomposable moiety) include isobornyl, tetrahydrofuranyl, tetrahydropyranyl, *dicyclopropylmethyl, and dimethylcyclopropylmethyl group*. Since there are only ten examples to choose from, it would have been obvious to one of ordinary skill in the art to choose dicyclopropylmethyl *(substituted cycloalkyl group having 3 ring carbon atoms)*, or dimethylcyclopropylmethyl *(substituted cycloalkyl group having 3 ring carbon atoms))* to be the R* moiety with a reasonable expectation that any one of these would work well as the R* moiety to provide polymer compositions that are transparent to short wavelength imaging radiation and are resistant to dry etching processes. *Furthermore*, Goodall et al teach on pg.10 the optional second monomer of the formula II that is to be copolymerized with their acid labile polycyclic monomer. According to the formula, R^5 to R^8 can independently be $-(CH_2)_n$-C(O)OR" (or any of the other six examples listed on lines 22-24 of pg.10) wherein R" represent H, alkyl, *monocyclic* and polycyclic *cycloaliphatic moieties*, cyclic ethers, cyclic ketones and cyclic ester (lactones). For the specific examples for the cycloaliphatic monocyclic moiety, the prior art lists *cyclopropyl, cyclobutyl*, cyclopentyl, and cyclohexyl (pg.11, lines 1-3). First of all, for R^5 to R^8, there are only seven examples to choose from, and therefore it would have been obvious to one of ordinary skill in the art to choose -

$(CH_2)_n$-C(O)OR" with a reasonable expectation of achieving polymer compositions that are transparent to short wavelength imaging radiation and are resistant to dry etching processes. Then there are only seven different kinds of examples for the R" group, and thus it would have been obvious to one of ordinary skill in the art to choose the monocyclic cycloaliphatic moiety such as cyclopropyl (*cycloalkyl group having 3 carbon atoms as presently claimed*) or cyclobutyl (*cycloalkyl group having 4 carbon atoms as presently claimed*) to be the R" group with a reasonable expectation of achieving polymer compositions that are transparent to short wavelength imaging radiation and are resistant to dry etching processes. Therefore, the prior art teaches the presently claimed polymer that is substantially free of aromatic groups and that comprises pendant acid labile groups that contain a cycloalkyl group having 3 or 4 ring carbon atoms. Also, since in the formula II, R^5 to R^8 *can independently* represent $(CH_2)_n$-C(O)OR" wherein R" can represent linear and branched alkyl (i.e., one of R^5 to R^8 can be $(CH_2)_n$-C(O)OR" wherein R" is cyclopropyl or cyclobutyl as discussed above and another one of R^5 to R^8 can be $(CH_2)_n$-C(O)OR" wherein R" is linear or branched alkyl group), the prior art also teaches the presently claimed alkyl ester groups of claim 23 and 28.

With respect to present claims 26-27, Goodall et al teach the coating of their resist solution onto a substrate such as a silicon wafer (see pg.1, lines 17-22, lines 25-26, pg.7, lines 11-14, pg.812, lines 5-7). Therefore, the prior art teaches the present inventions of these claims.

9. The following references cited here are for applicants's information.

WO 97/27515 teaches a resist composition suitable for KrF eximer laser comprising (I) a polymer prepared by polymerizing a (meth)acrylic ester containing an *allyl group* having at least two substituents (structure is shown on pg.7) with a monomer copolymerizable with the (meth)acrylic ester (such as methyl methacrylate, n-butyl methacrylate or t-butyl methacrylate according to PTO's on-site translation), and (ii) a photoacid generator.

Tomo et al (5,550,008) teach a photoresist composition comprising a substance containing a skeleton as at least a part of a main chain, the skeleton being obtained through polymerization of a vinyl alcohol type compound, at least some hydroxyl groups in the skeleton being protected by acid-releasing protective group (see Formula (2) of col.2), and a photoacid generator. In that formula, R^0, which is a protective group capable of being release with acid, can be ethyl vinyl ether group ($-CH_2CH_2-O-CH=CH_2$).

10. Applicants argue that Shida reports ally methacrylate for use in a negative resist whereas applicants claim a positive resist having acid labile groups wherein the acid-labile groups contain alkenyl group. Applicants further state that the cited polymer of the Shida does not contain acid-labile groups.

However, as explained above in paragraph 4 of this Office Action, Shida teaches that when the resin component is a copolymer of a *menthyl (meth)acrylate* and a compound containing a functional group to be decomposed or cross-linked by an acid, it can be formulated into a suitable chemically amplified resist by incorporating therein a *photo-acid generator*, and Shida teaches *ally ester* as one of examples for the functional group to be decomposed with an

acid (i.e., *acid-labile group*). Therefore, it is the Examiner's position that Shida's copolymer of allyl methacrylate and menthyl methacrylate can be used in a positive chemically amplified resist when combined with a photoacid generator since the prior art *clearly* teaches that such copolymer can be used in the form of positive type resist when combined with a photoacid generator. One of ordinary skill in the art would have immediately envisaged using the copolymer together with a photo-acid generator (instead of the polymerization initiator used in the Example II-2) to formulate a suitable chemically amplified positive resist with a reasonable expectation of providing a photosensitive material which is excellent in transparency to a light source of short wavelength and has a sufficient dry etch resistance. Therefore, applicants' arguments are found unpersuasive.

Applicants also argue that although Goodall is cited for a report of cyclopropylmethyl group, it is not seen that one would have any particular incentive to select that group out of the many possible alternatives as proposed by the instant rejection. Applicants furthermore argue that Goodall does not provide any suggestion of an acrylate polymer.

As already explained above in paragraph 8, since in Goodall's acid labile polycyclic monomer having formula I, the acid labile group $-(CH_2)_nC(O)OR^*$ has to be always present, and since there are *only ten* examples to choose from, it would have been obvious to one of ordinary skill in the art to choose dicyclopropylmethyl *(substituted cycloalkyl group having 3 ring carbon atoms)*, or dimethylcyclopropylmethyl *(substituted cycloalkyl group having 3 ring carbon atoms))* to be the R* moiety with a reasonable expectation that any one of these would work well

as the R* moiety to provide polymer compositions that are transparent to short wavelength imaging radiation and are resistant to dry etching processes. Therefore, in the absence of proof (submitted by applicants) that dicyclopropymethyl or dimethylcyclopropymethyl groups produce unexpected superior results over other possible groups for R* moiety, applicants' argument is found unpersuasive. As to the second argument of applicants, new claims 23 and 28 are not claiming an acrylate polymer but merely alkyl ester groups, and as explained above in paragraph 8, Goodall teaches the presently claimed alkyl ester groups. Therefore, applicants' argument is found unpersuasive.

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is (703) 305-0504. The examiner can normally be reached on Monday-Friday from 8:30 am EST to 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ms. Janet Baxter, can be reached on (703) 308-2303. The fax phone number for the organization where this application or proceeding is assigned is (703) 305-3599 for after final responses or (703) 305-7718 for all other responses.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0661.

S. Lee
March 8, 2001

JANET BAXTER
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